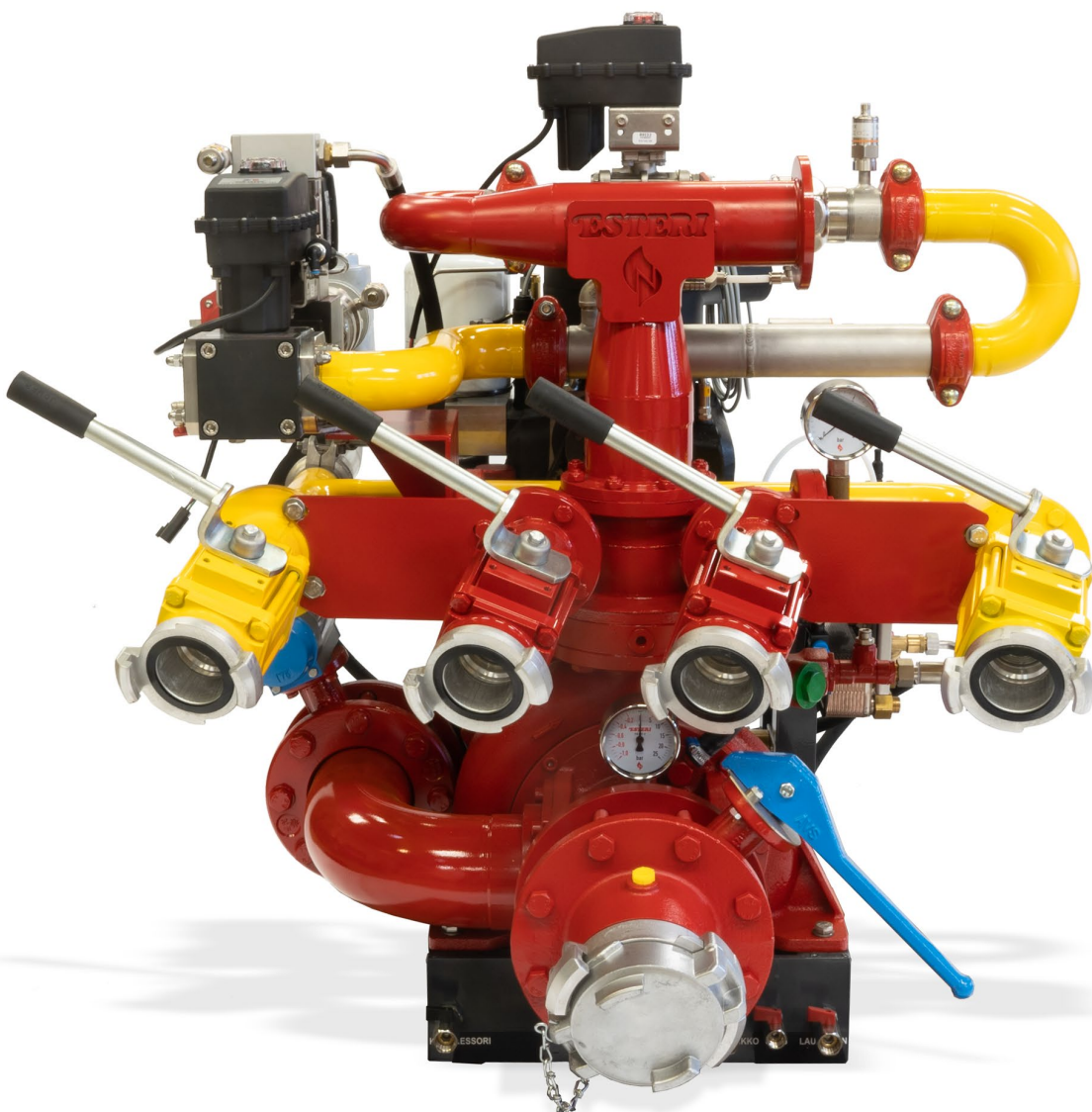


ESTERI FIRE PUMPS INSTRUCTIONS FOR USE AND MAINTENANCE



DECLARATION BY THE MANUFACTURER

Manufacturer: **ESTERI Group**
Veikko Nummela Oy

Address: Autoilijankatu 8 Salvumiehenkatu 10
20780 KAARINA 20320 TURKU
FINLAND FINLAND
www.esterigroup.fi

The manufacturer declares that our fire water pumps are designed and manufactured to comply with EN harmonized standards mentioned below.

designation:	FPN 10-3000	starting with serial number 1600-11
	FPN 10-4000	starting with serial number 1600-11
	FPN 10-2000	starting with serial number 750-11
	FPN 10-6000	starting with serial number 750-11
	FPH 40-250	

when designed, installed, operated, and maintained in accordance with the instructions given, fulfils the essential parts of the requirements of the following directives and may only be taken into use once it has been installed for full operational readiness:

1. Machinery directive 2006/42/EC
2. Low voltage directive 2006/95/EC
3. EMC directive 2004/108/EC

The fire pump has been tested and checked according to the following harmonised standards:

1. SFS-EN 1028-1 + A1
2. SFS-EN 1028-2 + A1
3. SFS-EN 14710-1 +A2
4. SFS-EN 14710-2 +A2

In Kaarina 19.4.2021



Iivari Kalliomäki
Managing Director

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1. General

About this manual

- Read this manual carefully before using the pump.
- Keep this manual in a protected place whilst easy at hand.
- Keep this manual with the pump when selling the pump or transferring it to another location.

Keep the Esteri fire pump in the best possible state

- Carry out all maintenance and checks according to this manual.

Warning symbols

Two different warning level symbols are used in this manual indicating danger or the possibility of danger which may lead to death, injury, or serious damage of/for the user or third parties. These warning symbols are important since the means of danger recognition and preventive actions mentioned ensure the safe use of the pump. Always follow the given instructions.



Non-compliance may cause death or serious injury.



Non-compliance may cause less serious injuries or damage to the pump or other property.

Products this manual deal with

Product:	ESTERI 1000
Pump type:	Centrifugal fire pump 10-10000
Product:	ESTERI 600
Pump type:	Centrifugal fire pump FPN 10-6000
Product:	ESTERI 400
Pump type:	Centrifugal fire pump FPN 10-4000
Product:	ESTERI 300
Pump type:	Centrifugal fire pump FPN 10-3000
Product:	ESTERI 200
Pump type:	Centrifugal fire pump FPN 10-2000

For pump ESTERI 300/25, type FPN 10-3000/FPH 40-250, a separate manual will be provided

Country of origin:	Finland
Manufacturer:	Veikko Nummela Oy Autoilijankatu 8 FI-20780 KAARINA
Telephone:	+358 2 2162 112
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Normal use of the product

The fire pump is used normally both for training and for firefighting. The pump has been designed for supporting strain that may occur to it, including strain caused by pressure and flow. The pump pressure should not be increased to a higher level than what the hoses to be used withstand. In other words, the same limit values that apply to the hoses also apply to the pump. Otherwise, the safety of the user is at risk. The maximum pressure allowed for pump pressure testing can be found in the specifications in chapter 3.

The pump is very reliable and withstands, to a certain extent, solid substances, and also contaminated water. Salty water is not harmful for the pump. The pump always must be cleaned when dirty or salty water was used. The corrosion risk for the pump is very small due to the materials chosen. The chamber of the pump and the impeller are usually gunmetal, and the shaft is stainless steel, which both are nearly fully resistant to corrosion. The formation of galvanic pairs is prevented by the materials chosen.

The pump is easy to use, and when used normally for firefighting, it does not overload. When testing, the situation is different since the pressure can then be raised to a higher level than what pressure resistance of the hoses requires. Also in pump tests, the limit values given in chapter 3 must be observed.



WARNING

1. Using the pump at closed pressure (in other words with all pressure valves closed) may cause damage to the pump. The water in the pump heats up very quickly when pumping at closed pressure. This does not immediately cause damage to the pump itself, but since the water temperature may rise to near boiling levels, this causes a great danger for the user.
2. Do not start the pump when the pressure valve is open.
3. When you open or close the pressure valve, turn down the motor revolution speed.
4. When pumping, the machine man must be in contact with the jet man and the former may never open the pressure valve without warning or increase the motor revolution speed too quickly.
5. Do not direct water towards other people.
6. Do not look into the nozzle.
7. Do not touch the pump's drive shaft when the pump is switched on.



IMPORTANT

1. The pump may not be used dry for **longer than two (2) minutes**. When the pump is used dry for longer, the pump's shaft seal may overheat and consequently the rubber parts may become brittle. The shaft seal carbon ring may also get damaged when cold water is let too quickly into the overheated pump. For this reason, the pump should first be let to cool down before letting water into it after overheating.
2. Solid items in the water, e.g., stones, may cause damage to the pump. There is not always a strainer in the suction opening of the pump, so the water tank filling pipe and the serial feeding connector must be equipped with a strainer having a mesh size of max. 12 mm. Items smaller than this goes through the impeller without causing problems. Fine sand or mud contained in the water may also cause problems, since they may intrude between the shaft seal and cause damage to it. When muddy water had to be used, the pump must be rinsed carefully after its use.
3. The pump may not be switched on when the vehicle motor is running at a high revolution speed. The impact caused when switching it on may primarily cause damage to the pump's drive shaft, but there is also the danger that the whole pump gets damaged.
4. Do not break the suction hose or the pressure hose by driving over them whilst the pump is in use.
5. Do not use the pump for anything else but suction and spraying of water (e.g., inflammable liquids or medical substances).
6. Make sure that the engine/PTO is sufficient for pump power demand.

2. Transport and temporary storage of the pump

Transport of the pump

The pump must be in upright position for transporting and it must be firmly attached to the loading platform.

For the time of the transport, the suction opening, and the pressure openings must be closed e.g., with a quick-disconnect lid or if necessary with tape, so that nothing can get inside the pump through the openings.

Temporary storage

No particular action is needed for the short-term storage of the pump. In case the temperature may go below 0°C, the draining tap should be left open and all other valves slightly open so that any water possibly still left in the pump does not cause the pump and the valves to break when freezing.

3. Pump specifications

Pump model	Classification EN 1028-1 (up to)	Nominal delivery 10 Bar (l/min)	Nominal speed (r/min)	Nominal power demand (kW)
ESTERI 200	FPN 10-2000	2000	3550	57
ESTERI 300	FPN 10-3000	3000	3800	90
ESTERI 400	FPN 10-4000	4000	3200	110
ESTERI 600	FPN 10-6000	6000	3500	180
ESTERI 1000	No EN norm atm.	10000	2450	265*
		40 Bar (l/min)		
ESTERI 300/25	FPN 10-3000/FPH 40-250	250	3800	120**
Volute material		Gunmetal or Aluminium		
Impeller material		Gunmetal		
Pump shaft material		Stainless steel		
Gearbox material		Aluminium		
Gearbox ratios (i)		1:1.17, 1:1.37, 1:1.53, 1:1.71, 1:1.92, 1:2.16 or 1:2.45		
Gearbox oil		Synthetic gear oil 80W140		
Impeller rotating direction		Clockwise or counterclockwise		
Limit pressure		17 Bar, 54,5 Bar for ESTERI 300/25		
Operating temperature range		-15°C ... +55°C (-30°C to be agreed)		

*1,5m suction lift

**Power consumption for separate operation of NP/HP stage

The exact fitting details for each individual pump can be seen in the annex delivered with the manual, which gives the pump specifications.

4. Installation instructions

Due to their small size, our pumps are easy to install on fire vehicles. Service and maintenance are easy when the pump is installed correctly. Correct installation is also essential for the proper operation of the pump. Below you find several aspects that are important to be considered when installing the pump.

4.1 Drive shaft

It is very essential to install the drive shaft correctly. The drive shaft transmits all the power needed by the pump from the motor to the pump. Therefore it is important to use a high-quality drive shaft. The drive shaft has to be balanced so that it is not subject to any vibrations. We use a standard flange in the pump. Usually, the flange is a constant velocity joint Löbro s.21 or a universal joint SAE 1400 (in small pumps also SAE 1300, sometimes also other specifications according to what has been agreed between the manufacturer and the customer).

When installing the drive shaft, the joint angles of the shaft may not be too big. When the joint angles are too big, this leads to both vibration and uneven operation. Usually, it is quite easy to hear when the angles are too big. When using the pump at a low revolution speed, a knocking noise is heard and sometimes banging noise can be heard. When the joint angles are too big, this may cause damage to the bearings of the pump. Even though high-quality bearings are used in the pump, they do not withstand hard “hammering” of the drive shaft.

We cannot define a specific angle that should not be exceeded. By rule of thumb, the angles should not exceed 7°, but the angle depends on the shaft length and on the rotation speed. In some cases, the angle may even be increased. The supplier of the drive shaft can help with designing the drive shaft correctly.

4.2 Suction pipe

The suction pipe has to be designed depending on the pump's output. The pipes and hoses that are connected to the pump's suction side must be designed such that they do not restrict the flow. We know from fluid dynamics that bends slow down the flow. Also, the length of the pipes and hoses has an impact on the flow resistance. The nominal size of the suction line parts must be at least the same size as the pump's suction flange. When the suction line is too small or there are too many bends, this may cause pump cavitation. In case valves are installed in the suction line, it must be kept in mind that also valves cause pressure loss. Sometimes it may be necessary to use a one size bigger valve than what is otherwise the nominal size of the suction line.

4.3 Pressure outlets

We manufacture manifolds that are designed for the use in our pumps. They are designed such that the pressure loss is as small as possible, and problems thus will not occur. We have several choices for pressure head manifolds and flanges. Hence, it is easy for our customers to get what is desired without having to make weldable outputs. The pressure measurement connection is directly in the manifold. If for any reason the customer wishes to use a pressure head that we cannot deliver, there is a DIN standard pressure flange in the pump casing.

4.4 Maintenance and repair

Our pumps are easy to service and repair. Enough space must be left around the pump so that there is access to the rare service points. In the gearbox, the filling and draining plugs and the oil level indicator must be accessible. In case there is an automatic primer in the pump, space has to be left on both sides of the gearbox for repairing the primer. When the pump is installed correctly, it is not necessary to detach the pump from the vehicle for repairing the primer or for routine service actions.

4.5 Detaching the pump

It should be possible to detach the pump without excessive effort. When designing the vehicle and installing the pump, it must be considered that there is the possibility to detach the pump. Below several important aspects that must be considered:

- The suction and pressure lines must be connected to the pump with flange connections such that the pump can be detached from the vehicle without having to detach all lines.
- The pump mounting base must be designed and manufactured such that the detachment of the pump is as easy as possible.
- It must be possible to detach the pump's drive shaft from the flange by removing only the drive shaft and the flange protections.
- When detaching the pump, great caution must be observed, so that the pump does not fall down nor consequently cause damage or injury to you or other people or objects.
- When repairing the pump, it must be placed on a stable table or similar and to be reliably fastened at its installation legs.

5. Starting the pumping, pumping and ending the pumping

This chapter describes the normal use of the pump. We cannot give exact instructions about all details since every builder does the installation in their own way. The adjustment of the revolution speed may be electric or mechanical, and the valves may be manual or actuated. Hence, the operating switches and other control devices are different, and the builder writes a detailed instruction about their exact use. This manual gives general recommendations for the correct and safe use of the fire pump.

5.1 Starting the pumping

This is a general description of the actions when starting the pumping. The builder gives a detailed instruction for the operating controls of each vehicle in his own manual. In the instruction below, the use of pumps both with and without primer is dealt with.

<p>Pump without primer</p>	<ul style="list-style-type: none"> • Connect the equipment that is intended to be used. Follow your supervisor's instructions or previously agreed instructions for actions. • Close the draining taps, the venting taps and the pressure valves (also the valves of the water cannon, the hose reel and the so-called diverter valves). • Start the motor (in case it is not already running) and switch on the pump. Follow the connection instructions of the vehicle builder. • Open the valve of the suction pipe coming from the water tank or, in case of serial feeding, the feeding hose valve. • Let the air contained in the pump escape carefully either through a separate venting tap or through a pressure valve. • There is now water in the pump and when the sign is given, you can open the necessary valve/s. The pump pressure is adjusted by regulating the motor revolution speed. Follow the instructions of the vehicle builder. Never increase the revolution speed too quickly since a quick pressure increase may damage hoses and other equipment. • When the water is connected to the pressure hoses, go to the pumping section.
<p>Pump equipped with compressed air or electrical primer</p>	<ul style="list-style-type: none"> • When you intend to use water contained in the vehicle water tank or serial feeding, proceed as described above for pumps without primer. • When intending to suck water from a so-called nature source by using suction hoses, adhere to the following instructions: <ul style="list-style-type: none"> • Connect the suction hoses to the pump's suction opening. Make sure that the suction hose seals are undamaged and clean and

	<p>that they are slightly lubricated. Dirty or broken seals slow down the priming or prevent it completely. Be very careful when connecting the suction hoses and letting them down into the water. Use a suction strainer at the end of the suction hose. Take care that the suction strainer does not go to the very bottom; otherwise, the pump may suck sand or mud. A good way is to use e.g., an empty plastic can or similar for floating.</p> <ul style="list-style-type: none"> • Connect the pressure hoses and other equipment intended to be used. • Close the draining taps, the venting taps and the pressure valves (also the valves of the water cannon, the hose reel and the so-called diverter valves). • Start the motor (in case it is not already running) and switch on the pump. Follow the connection instructions of the vehicle builder. • Compressed air primer: Open the closing valve of the compressed air pipe of the compressed air primer and switch on the compressed air primer by turning the primer's operating lever into the horizontal position. Air is starting to flow out of the primer's blow-off nozzle. • Electrical primer: Start the priming process by switching ON the electric motor. Priming pump is now activated. • When water is starting to come out of the blow-off nozzle (at the same time, the pump's noise changes and the pressure gauge starts showing pressure), or from the outlet of the priming pump (in the case of electric primer), you can carefully open the pressure valve and let the water get into the hose. • When the water starts flowing steadily, you can close the primer by turning the operating lever into the upright position or stop the electric motor. • The pump pressure is adjusted by regulating the motor revolution speed. Follow the instructions of the vehicle builder. Never increase the revolution speed too quickly, since a quick pressure increase may damage hoses and other equipment. • When the water is connected to the pressure hoses, go to the pumping section.
<p>Pump equipped with automatic primer (dual piston)</p>	<ul style="list-style-type: none"> • When you intend to use water contained in the vehicle's water tank or serial feeding, proceed as described above for pumps without primer. • When intending to suck water from a so-called nature source by using suction hoses, adhere to the following instructions: <ul style="list-style-type: none"> • Connect the suction hoses to the pump's suction opening. Make sure that the suction hose seals are undamaged and clean and that they are slightly lubricated. Dirty or broken seals slow down the priming or prevent it completely. Be very careful when

	<p>connecting the suction hoses and letting them down into the water. Use a suction strainer at the end of the suction hose. Take care that the suction strainer does not go to the very bottom; otherwise, the pump may suck sand or mud. A good way is to use e.g., an empty plastic can or similar for floating.</p> <ul style="list-style-type: none"> • Connect the pressure hoses and other equipment intended to be used. • Close the draining taps, the venting taps and the pressure valves (also the valves of the water cannon, the hose reel and the so-called diverter valves). • Start the motor (in case it is not already running) and switch on the pump. Follow the connection instructions of the vehicle builder. • When the pump connects, the primer starts automatically. Air is coming out of the primer's discharge pipe and in the end water. The primer makes a noise coming from the pumping of the pistons. • The primer sucks the best when the vehicle motor revolution speed is approx. 1000 r/min. Do not increase the motor revolution speed to a higher level before the water has got up into the pump. • When the water comes into the pump, the primer automatically disengages (under the influence of the pump pressure, the primer pistons subside against the lids of the primer in approx. 1.5–2.5 bar pressure and at the same time close the discharge pipes). The flow out of the discharge pipes ends and the sound of the primer pistons can no longer be heard. • The pump pressure is adjusted by regulating the motor revolution speed. Follow the instructions of the vehicle builder. Never increase the revolution speed too quickly since a quick pressure increase may damage hoses and other equipment. • When the water is connected to the pressure hoses, go to the pumping section.
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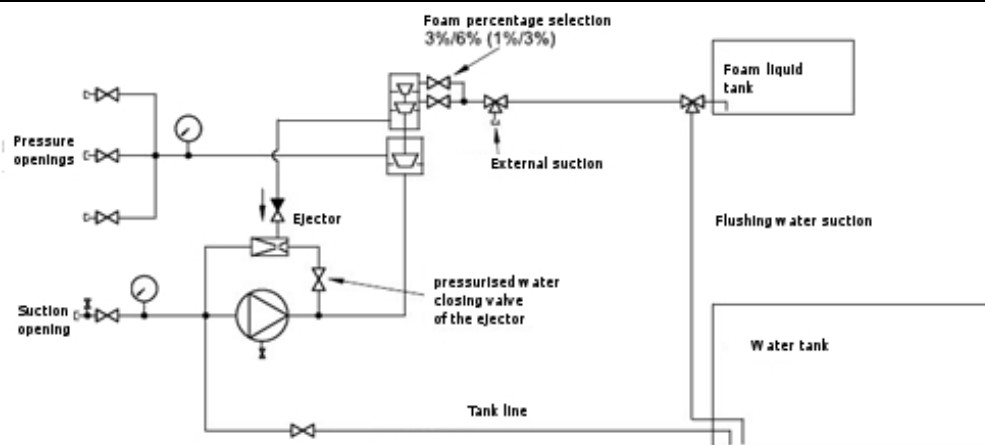
5.2 Pumping

<p>Pump without primer</p>	<ul style="list-style-type: none"> • After the starting actions for pumping, there is pressure in the pump and the water flows steadily (provided valves have been opened). Now the actual pumping may start. • For increasing the pump pressure, you have to increase the motor revolution speed. The pump pressure increases when the revolution speed increases, provided the flow amount remains the same. • When the flow amount is increased (more jets are opened or nozzle openings are increased), the pump pressure decreases provided that the motor revolution speed is kept at the same level.
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	<ul style="list-style-type: none"> • The Esteri fire pump output curves are very steady so that at normal outputs, a water amount change only very slightly affects the pump pressure. If necessary, the pump user has to adjust the motor revolution speed. <p>REMEMBER!</p> <ul style="list-style-type: none"> • If you try to take more water from the pump than what the output implies, it is not possible for the pump to achieve the desired pressure. Pump cavitation will start. • Cavitation can be prevented by decreasing the flow. • When the water feeding towards the pump ends (e.g. water tank gets empty) or the flow amount is too small, the pump pressure drops. Decrease the motor revolution speed in these cases to idle speed and if the water feeding to the pump cannot be re-established immediately, switch off the pump. • Check the reason for the lack of water and re-establish the water feeding according to your possibilities. • Start the pumping as described previously in the “Starting the pumping” section. • When the pressure is stable again, continue pumping normally.
<p>Pump equipped with compressed air or electrical primer</p>	<ul style="list-style-type: none"> • When you use tank water or the pump is connected to another pump or to a hydrant by serial feeding, proceed as described above for pumps without primer. • When suction hoses and a suction strainer are connected to the pump and you use “natural water”, the following has to be taken into account in addition to the aspects mentioned above: <ul style="list-style-type: none"> • Check the reading of the under pressure gauge (suction/pressure gauge -1 .. 0 .. +25 bar). • When the flow amount is very small, the under pressure gauge shows the actual suction height (e.g. reading -0.3 bar means 3 m suction height). • When the flow amount increases, also the reading of the under pressure gauge increases (e.g., reading -0.6 bar means, if the suction height is the same 3 m as in the previous example, that the pressure loss in the suction hose due to the flow amount is 0.3 bar). • The under pressure gauge reading may not exceed -0.6 bar under pressure, since the pump cavitation risk increases significantly at higher under pressure readings. Cavitation may lead to pump damage. • Based on the examples given above, it can be concluded that the pump must be located as closely as possible to the water surface and the suction line diameter must be sufficiently big. • An increase of the under pressure reading on the under pressure

	<p>gauge whilst pumping may also be due to a blockage of the suction line. When the under pressure has increased without a flow amount increase, check that no impurities have accumulated around the suction strainer preventing the flow. Clean the strainer if needed.</p> <ul style="list-style-type: none"> • When there is air flowing with the water (the jet “splatters”), the suction line strainer may be too close to the water surface and the pump sucks in air. Remedy this fault by submerging the suction strainer deeper. • In case there is still air coming into the pump, even though the suction strainer is submerged sufficiently deep, there is a leak in the suction line seals. Remedy this fault by cleaning the seals and the seal grooves and by slightly lubricating the seals with petrolatum.
<p>Pump equipped with automatic primer (dual piston)</p>	<ul style="list-style-type: none"> • When the pump is equipped with an automatic primer, the procedure is nearly the same as for pumps equipped with compressed air primers. Below several aspects that nevertheless have to be taken into account: <ul style="list-style-type: none"> • The primer goes on automatically when the pump pressure decreases to approx. 1–1.5 bar pressure. • When you pump quite large amounts of water at a low pressure, without a jet pipe at the end of the hose (e.g. cellar emptying or flood protection), make sure that the pump pressure stays at a sufficiently high level such that the primer does not turn on in vain. If necessary, throttle the flow by closing the pressure valve to such an extent that the primer turns off. • The primer may also turn on when the suction strainer gets blocked (the water amount decreases and drops the pump pressure, the suction gauge shows under pressure). Remedy this fault by cleaning the strainer. • Also air getting into the suction line (suction strainer too close to the surface or seal leakages) may cause the pump pressure to decrease and start the primer. Remedy this fault by submerging the suction strainer deeper or by cleaning the seals and the seal grooves and by slightly lubricating the seals with petrolatum.

Pump equipped with foam mixing system



- The purpose of the automatic foam mixing system is to add the desired amount of foam liquid (generally either 3 % or 6 % or alternatively either 1 % or 3 %) to the fire fighting water. The selected mixing ratio stays the same, no matter what amount of water is flowing through the pump.
- There is an ejector in the automatic foam mixing system that creates under pressure in the foam suction line under the influence of the pressurised water it gets from the pump. The under pressure makes the foam liquid flow from the foam liquid tank through the foam liquid control system to the ejector and from there onwards to the suction side of the pump. The foam liquid control system adjusts the foam liquid quantity such that it corresponds to the water flow.
- Since the foam mixing system feeds the foam liquid onto the suction side of the pump, the foam liquid and water mix can be taken from all pressure outlets of the pump.
- The pumping is started as described in section “5.1 Starting the pumping” for the different pump types.
- When the starting actions have been completed and the pump is ready for continuous use, the foam mixing system can be taken into operation as follows:
 - Open the pressurised water valve of the ejector (size NS 25, located on the outer shell of the pump chamber)
 - Open one of the foam liquid mixing ratio selection valves (size NS 40, located between the foam mixer frame and the “Y”-branch). The upper valve is for a 3% mixing ratio (alternatively 1%) and the lower for 6% mixing ratio (alternatively 3%).
 - Open also the foam liquid tank closing valve, or, in case you are using a separate foam liquid tank, connect the suction pipe of the external foam suction and open its closing valve.
 - In case there are compressed air operating controls in the foam mixer valves, their control is organised such that with one control several valves are opened. The vehicle builder hands out a detailed instruction about the operation of the control devices.

	<ul style="list-style-type: none"> • When the water flow stops, also the foam liquid flow is stopped automatically. When the water flow starts again, also the foam liquid flow starts.
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5.3 Ending the pumping

Pump without primer	<ul style="list-style-type: none"> • When you receive the order to stop pumping: <ul style="list-style-type: none"> • Decrease the motor revolution speed to idle speed. • Switch off the fire pump. • Close the valve of the water tank suction pipe. • Take off all hoses and other equipment from the pump. • Open the draining tap and the pressure valves in order to empty the water out of the pump. • Attach the lid of the suction opening onto the pump.
Pump equipped with compressed air or electrical primer	<ul style="list-style-type: none"> • When you receive the order to stop pumping: <ul style="list-style-type: none"> • Decrease the motor revolution speed to idle speed. • Switch off the fire pump. • Take off all pressure hoses and other equipment from the pump. • Open the draining tap and the pressure valves in order to empty the water out of the pump. • Take off all suction hoses and the suction strainer. Be very careful when you lift the suction hoses and the suction strainer out of the water. • Attach the lid of the suction opening onto the pump.
Pump equipped with automatic primer (dual piston)	<ul style="list-style-type: none"> • When you receive the order to stop pumping: <ul style="list-style-type: none"> • Decrease the motor revolution speed to idle speed. • Switch off the fire pump. • Take off all pressure hoses and other equipment from the pump. • Open the draining tap and the pressure valves in order to empty the water out of the pump. • Take off all suction hoses and the suction strainer. Be very careful when you lift up the suction hoses and the suction strainer out of the water. • Attach the lid of the suction opening onto the pump. • Switch on the pump again for a moment. The draining tap and the pressure valves may be open. When there is no more water coming out of the discharge pipe of the primer, you can switch off the pump. By doing so, it is made sure that no water is left in the primer, which in winter may freeze and break the primer.

<p>Pump equipped with foam mixing system</p>	<ul style="list-style-type: none"> • When you receive the order to stop pumping: <ul style="list-style-type: none"> • Close the closing valve of the foam liquid tank suction pipe and open the flushing water suction valve of the foam mixer (installed by the body manufacturer). • Still leave open the pressurised water closing valve of the ejector. Open one after the other both the 3% mixing ratio selection valve and the 6% mixing ratio selection valve and pump water from at least one, but preferably from all pressure outlets that have been used, until there is no longer any foam in the water coming out of the jet pipes. • Decrease the motor revolution speed to idle speed. • Switch off the fire pump. • Close the valve of the water tank suction pipe. • Open the draining tap and the pressure valves in order to empty the water out of the pump. • Lift the draining lever of the foam mixer and keep it up for a while so that the flushing water contained in the foam mixer can get out of the foam mixer. • Attach the lid of the suction opening onto the pump. • In case there is not enough water left in the vehicle water tank for flushing the foam mixing system, the flushing has to be carried out as soon as possible after filling the water tank. Foam liquid that is not flushed dries in the lines and valves and over time prevents the devices from working properly.
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The instructions above give general advice on the use of the pump in different situations. For adhering to the right instructions, check the customer-specific structure specifications delivered as annex to know which equipment has been installed to the pump.

6. Maintenance instructions

This chapter concerns all our pumps and for this reason, we have made a general maintenance instruction concerning all pumps. In case some aspect only applies to a certain pump, this is mentioned separately, and the pump concerned is mentioned. In the specifications in chapter 3 you can check your pump type and the equipment installed to it.

6.1 Pumps

When talking about a pump, we mean the actual pump part that pumps water and no other equipment outside it. Outside the pump is also the gearbox.

<p>ESTERI 200 ESTERI 300 ESTERI 400 ESTERI 600 ESTERI 1000</p>	<ul style="list-style-type: none"> • No maintenance points in the pump itself. • The most important thing is to keep the pump clean. Dirty water may damage the shaft seal. • When a foam mixer is connected to the pump, the pump must be rinsed carefully after every use of the foam mixer. The foam liquid does not cause damage to pump parts, but foam liquid that is not rinsed away dries in the pump and the shaft seal and over time prevents the devices from working properly. • When there is a suction opening connected to the pump, its seals must be cleaned regularly. For cleaning, the seals must be detached from their seal grooves and be cleaned carefully. Also, the seal grooves must be cleaned. After cleaning, a thin petrolatum layer must be brushed both onto the bottom of the seal groove and onto the seal surface. Damaged seals have to be replaced with new ones.
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6.2 Gearbox

For the gearbox, there are maintenance actions that have to be taken from time to time. In the following, you find instructions for the actions:

Gearbox type	Actions
<p>Gearbox without automatic primer</p>	<p>There is a pair of gear wheels in the gearbox with which the drive shaft rotation speed is adjusted for the impeller. For the lubrication of the gear wheels and the gearbox bearings, use a gear oil complying with the recommendation further below. There is an oil level indicator in the gearbox. Check the oil level</p>

	<p>regularly on the oil level indicator. The oil level must be above the middle of the oil level indicator.</p> <p>The gearbox oil must be changed every time the vehicle motor oil is changed, but at least once a year. When the pump is used a lot, it is recommended to change the oil every 200 hours.</p> <p>The oil amount is approx. 0.5 litres (excl. ESTERI1000) depending on the gearbox position and the transmissions of the gear wheels. There is a plug with a magnet at the bottom of the gearbox for draining and on the gearbox or at the side there is a filling/breather plug. Clean the draining plug carefully before attaching it back into the gearbox and adding new oil into the gearbox.</p>
<p>Gearbox equipped with automatic primer</p>	<p>There is a pair of gear wheels in the gearbox with which the drive shaft rotation speed is adjusted for the impeller.</p> <p>For the lubrication of the gear wheels and the gearbox bearings, use a gear oil complying with the recommendation further below. There is an oil level indicator in the gearbox. Check the oil level regularly on the oil level indicator. The oil level must be above the middle of the oil level indicator.</p> <p>The gearbox oil must be changed every time the vehicle motor oil is changed, but at least once a year. When the pump is used a lot, it is recommended to change the oil every 200 hours.</p> <p>The oil amount is approx. 0.7 litres (excl. ESTERI1000) depending on the gearbox position and the transmissions of the gear wheels. There is a plug with a magnet at the bottom of the gearbox for draining, and on the primer intermediate body, there is a filling/breather plug. Clean the draining plug carefully before attaching it back into the gearbox and adding new oil into the gearbox.</p> <p>There are no parts in the automatic primer needing regular maintenance.</p> <p>Piston pump type primers are installed in the intermediate body on the sides of the gearbox. The primers can be easily removed for repair by opening 4 hexagonal screws of both primers. The eccentric piece using the primers is located on the pump shaft inside the intermediate body. For exchanging the eccentric, the intermediate body has to be detached from the gearbox lid (in some cases, the Cardan flange has to be detached before detaching the intermediate body).</p>

6.3 Lubrication oil recommendation

Always use high-quality gear oil. We recommend using oil listed below:

Teboil	Hypoid 80W-140
Neste	Axle 80W-140
Mobil	Mobilube HD 80W-140
Shell	Shell Spirax S3 AS 80W-140
ENI	ENI Rotra MP 85W140 (ESTERI 300/25)

7. Troubleshooting

Problem	Cause	Solution
Water leaking from below the pump	<p>There is a mechanical shaft seal in the pump and an oil seal in the gearbox. Between these two seals, below the pump, there is a leakage hole. The purpose of this hole is to help the user notice possible leakages of the seals.</p> <p>When water is coming out of the leakage hole, the shaft seal of the pump is damaged. When oil is coming out of the leakage hole, the oil seal of the gearbox is leaking.</p> <p>If the water is leaking at high pressure, there is the risk that the water leaks into the gearbox.</p>	<p>If the water is leaking only in drops, you can continue using the pump with clean water for some time. There may be impurities between the seal that are washed away when using clean water and the leakage stops when the impurities go away.</p> <p>If the leakage continues or the water is leaking abundantly, the shaft seal is broken and must be changed.</p>
High "howling" sound from the pump	<p>The impeller of the pump is rotating at a quite high revolution speed. The gear wheels of the gearbox, the pump drive shaft, the vehicle motor, the vehicle gearbox, and the power take-off cause some noise when the pump is running. The noise increases when the revolution speed and the water amount to be pumped are increasing.</p>	<p>This is normal and does not require any special action unless the sound becomes rattling or otherwise abnormal.</p>
The pump does not raise pressure.	<p>The pump develops pressure when there is water in the pump and the impeller is rotating. The desired pressure is obtained by adjusting the pump (= impeller) rotation speed.</p>	<p>Increase the pump rotation speed. If this does not help, check that the pump gets enough water. Check that the valve of the water tank suction pipe is open when pumping from the water tank. Check that the serial feeding pressure is sufficient (1 ... 6 bar) when using serial feeding.</p>

<p>The pump makes loud noise. It sounds like small explosions.</p>	<p>Probably cavitation. Cavitation occurs when you try to take out more water of the pump than what is getting there (e.g., too small or blocked suction pipe, too big suction height or too small serial feeding pressure / output). In pump cavitation, small steam bubbles develop in the pump due to under pressure. The bubbles burst and create noise. The bursting of the bubbles causes corrosion of the pump internals and hence shortens the operating lifetime of the pump.</p>	<p>Decrease the revolution speed of the pump. Check, when using a suction line, that the suction line is not blocked. Check, when using the pump with serial feeding, that the serial feeding pressure is sufficient and that the water source (hydrant, other pump etc.) output is big enough. Close some jets or decrease the nozzle size so that the quantity of water leaving the pump decreases.</p>
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